

Location of Stratocumulus Cloud-top Heights in the Presence of Strong Inversions

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NASA/GSFC, Greenbelt, MD

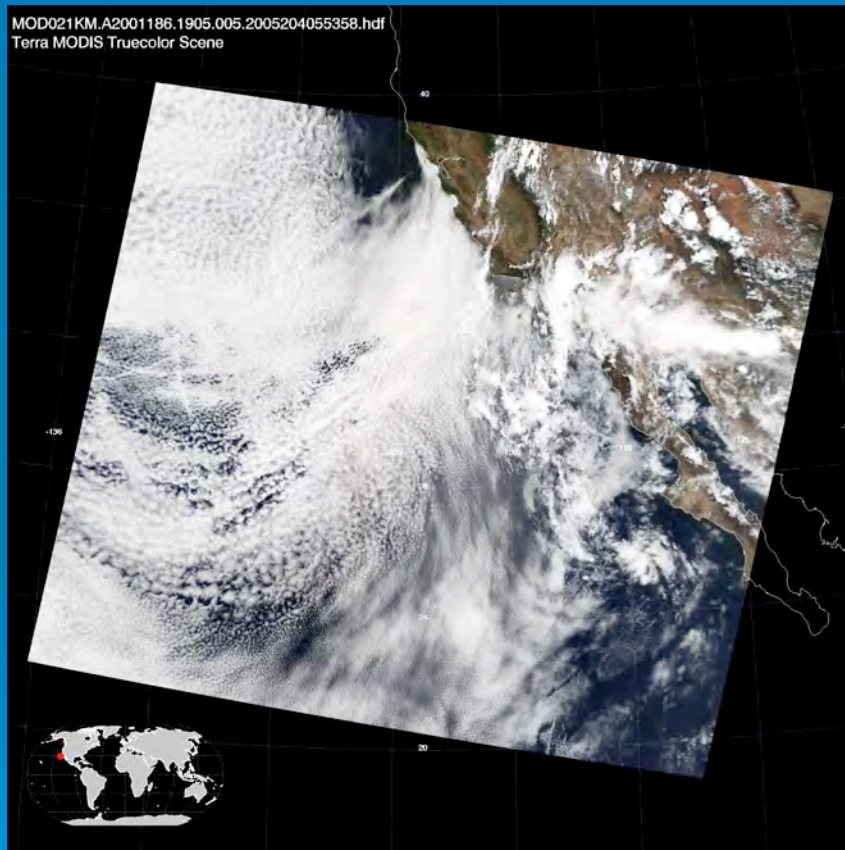
Bo-Cai Gao, NRL, Washington DC

Jim Coakley, Oregon State U., Corvallis, OR

Richard Frey, SSEC, Madison, WI

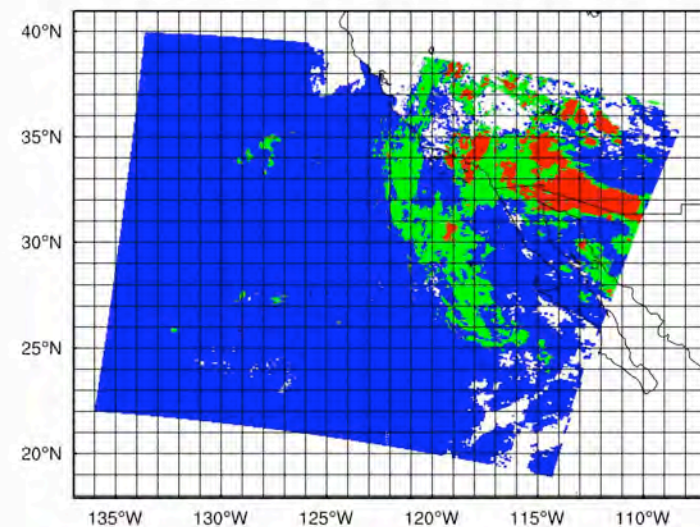
Others not listed above

July 5 2001 1905 UTC



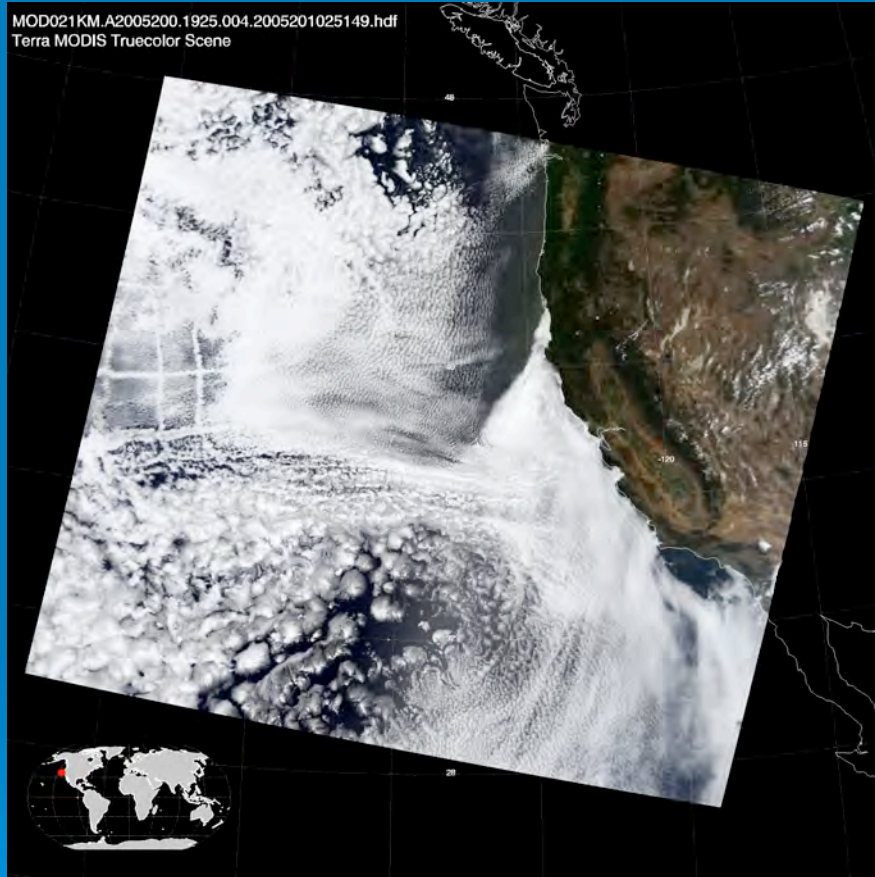
Terra MODIS Cloud_Height_Method

MOD06_L2.A2001186.1905.005.2006158143211.hdf



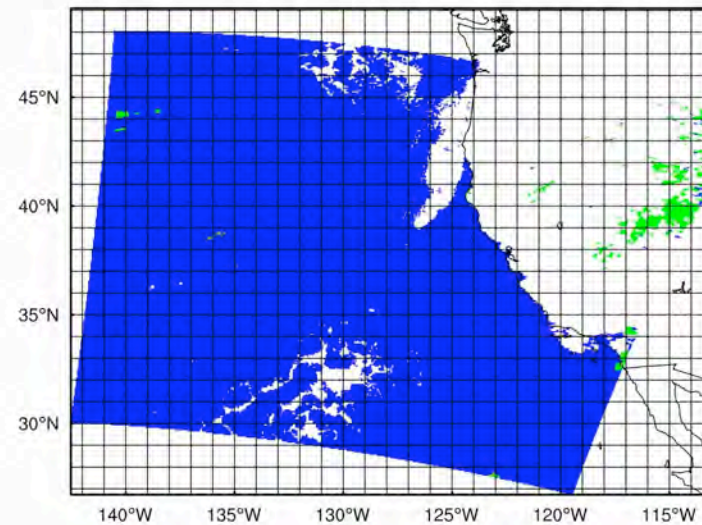
1 - CO₂-slicing retrieval from bands 36 and 35
3 - CO₂-slicing retrieval from bands 35 and 33
6 - window channel retrieval

July 19 2005 1925 UTC



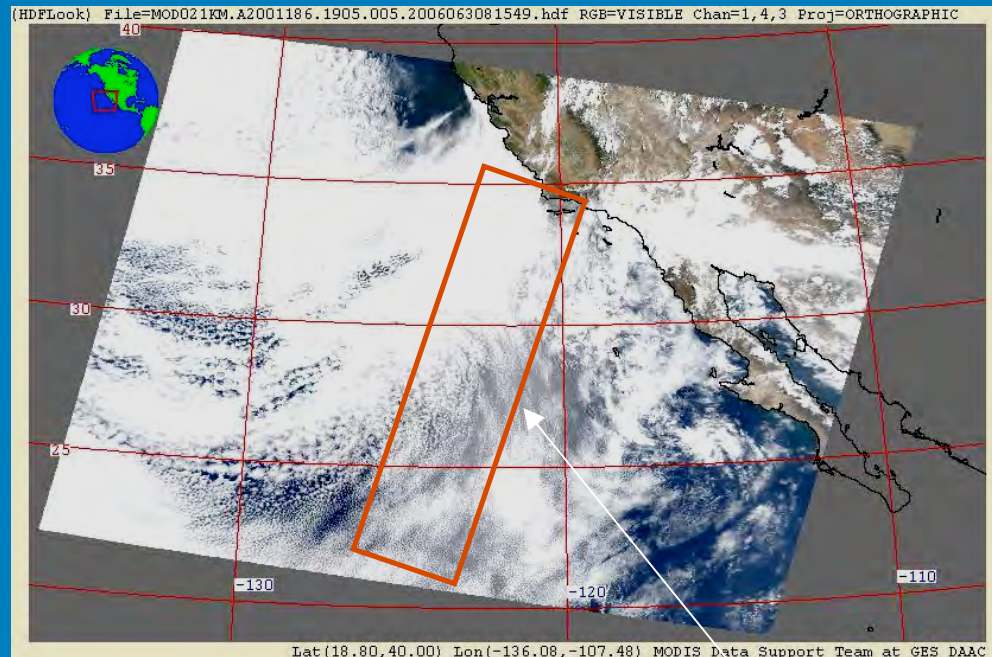
Terra MODIS Cloud_Height_Method

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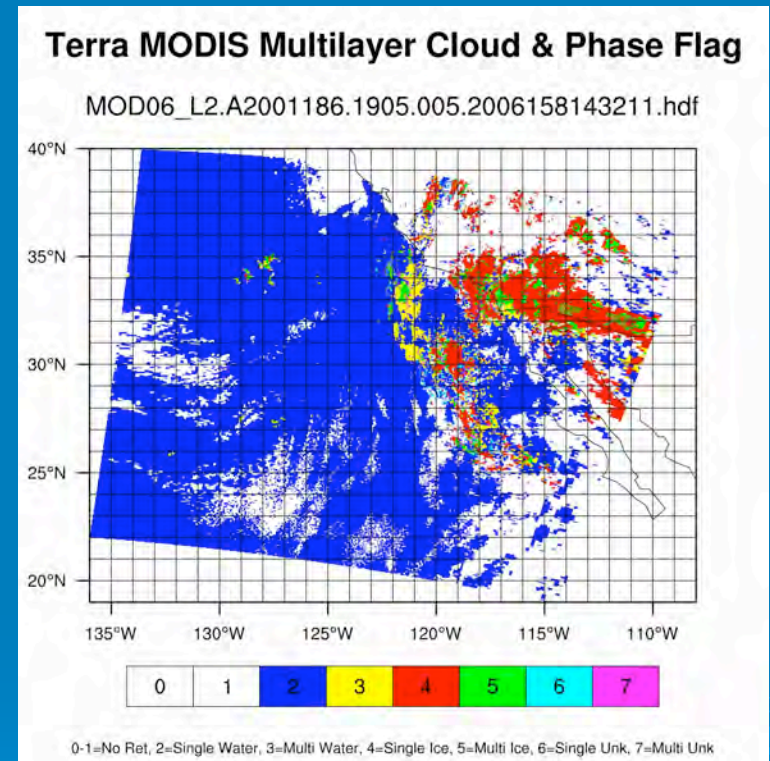


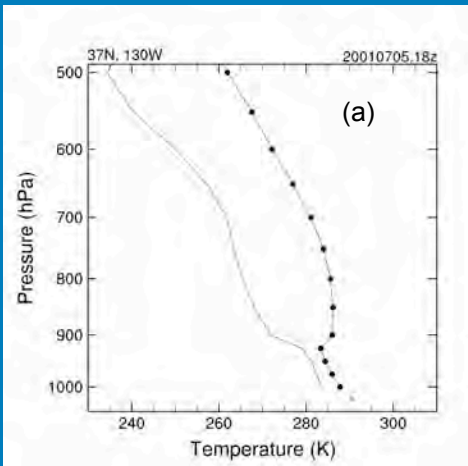
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- 6 - window channel retrieval

July 5 2001 1905 UTC

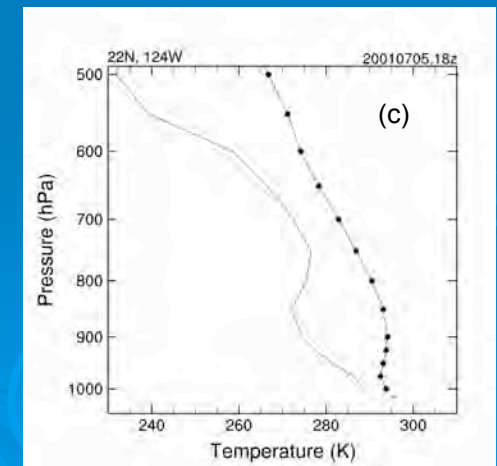
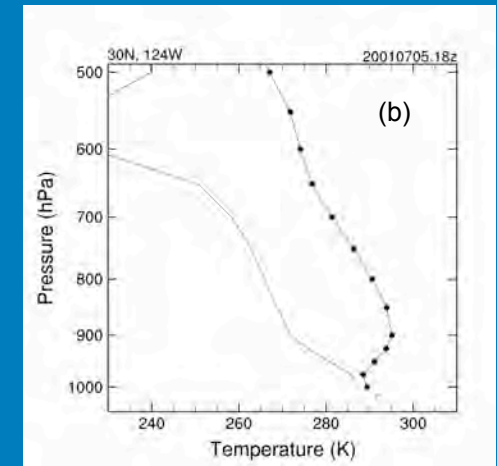
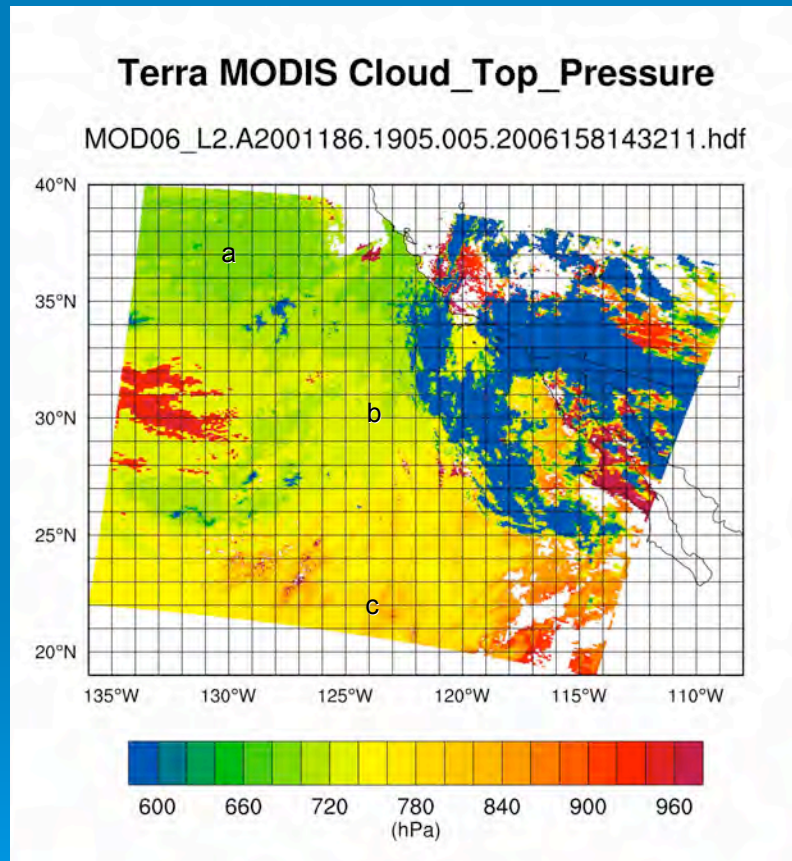


MISR swath



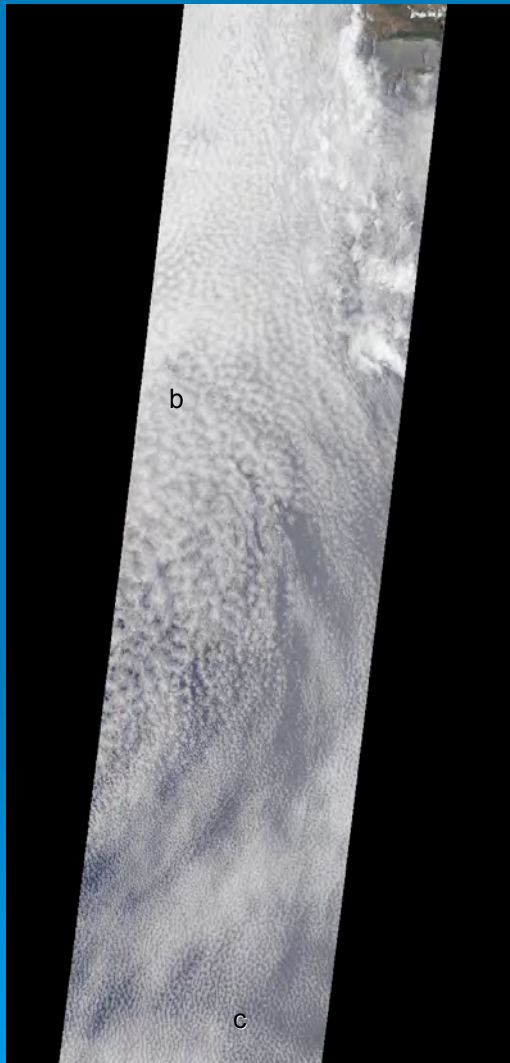


“Soundings”
are from
NCEP GDAS
analysis

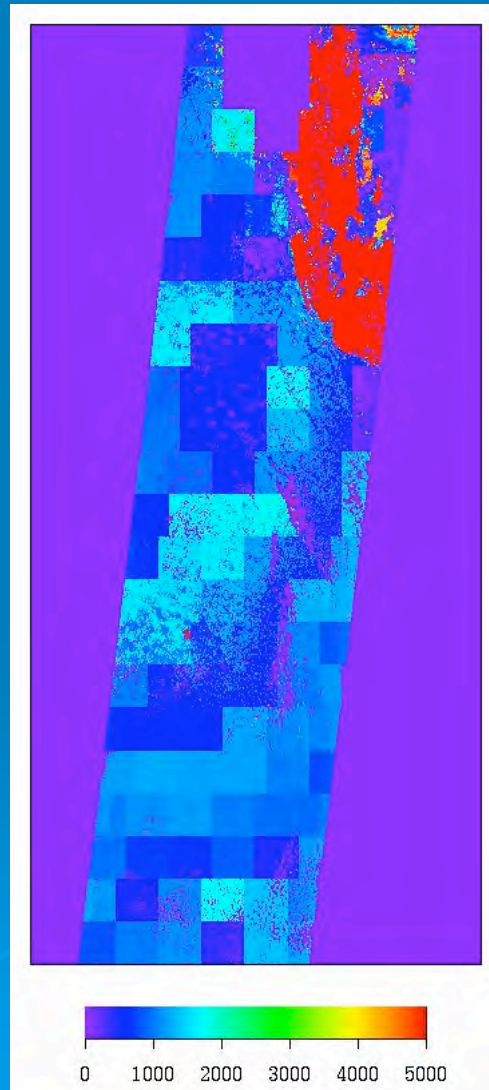


MISR MODIS comparison

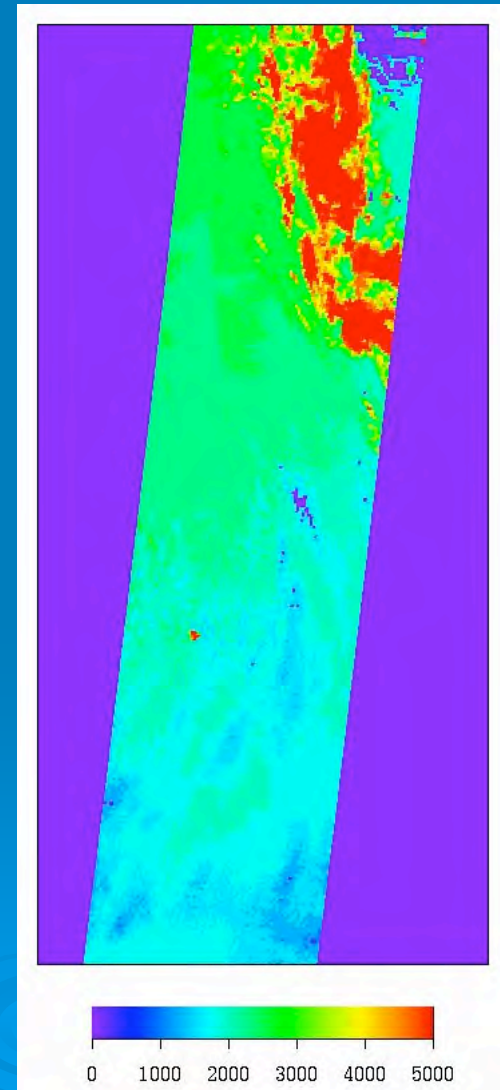
MISR AN RGB



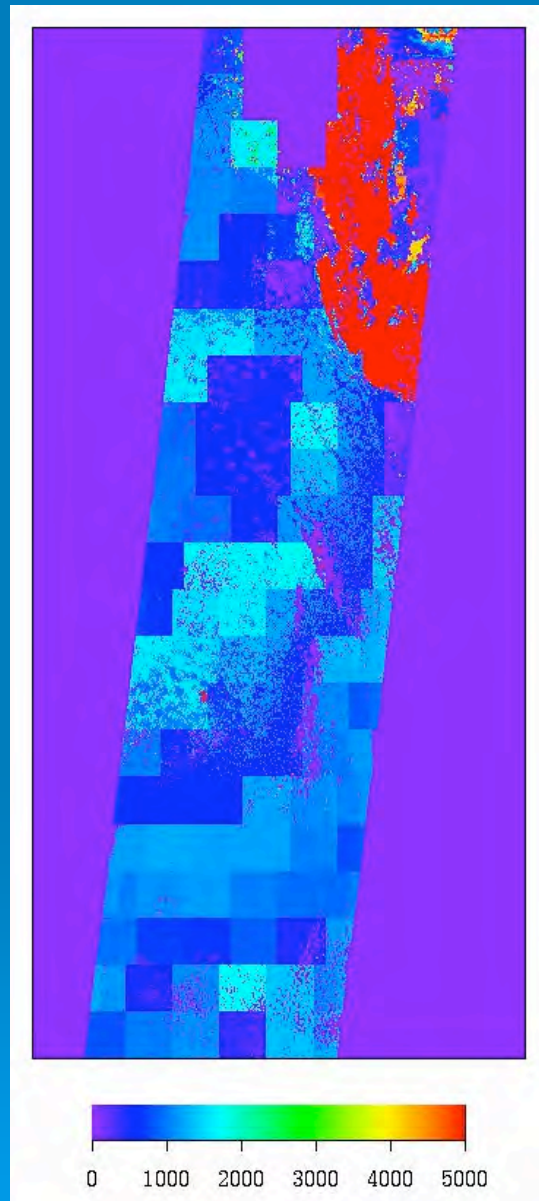
MISR CTH [m]



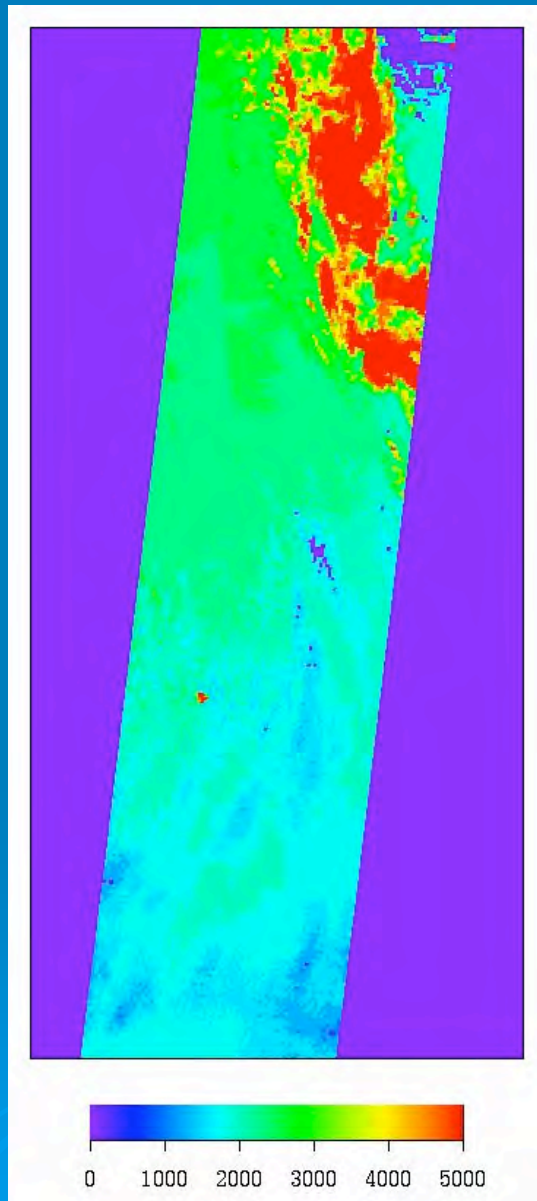
MODIS Collection 5 [m]



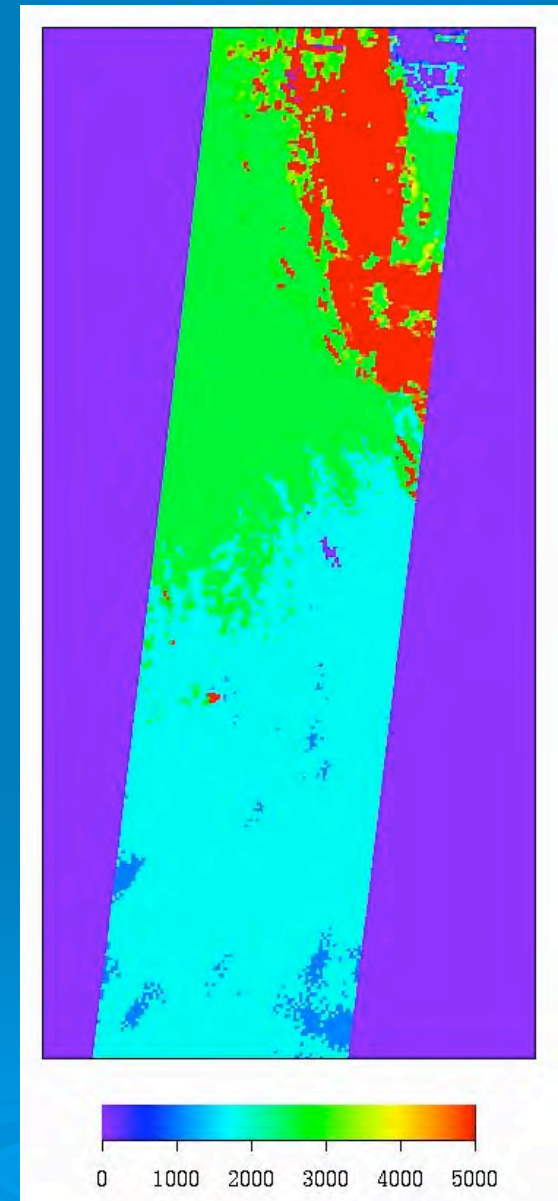
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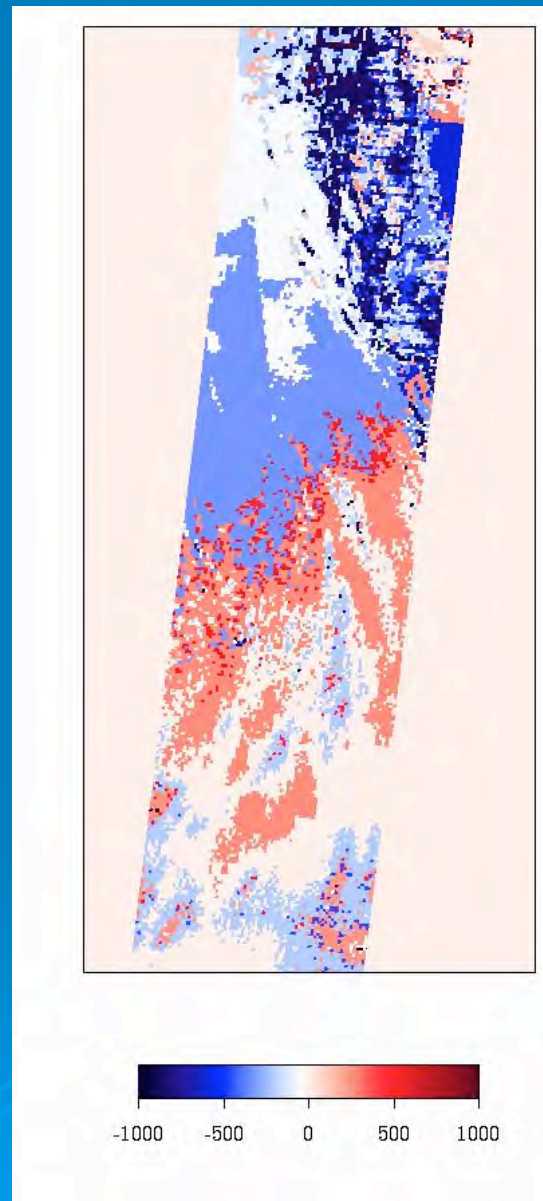
Collection 5



Collection 4

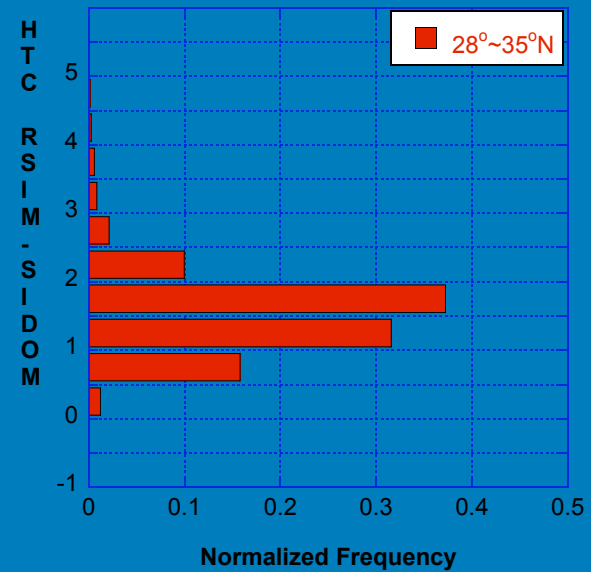
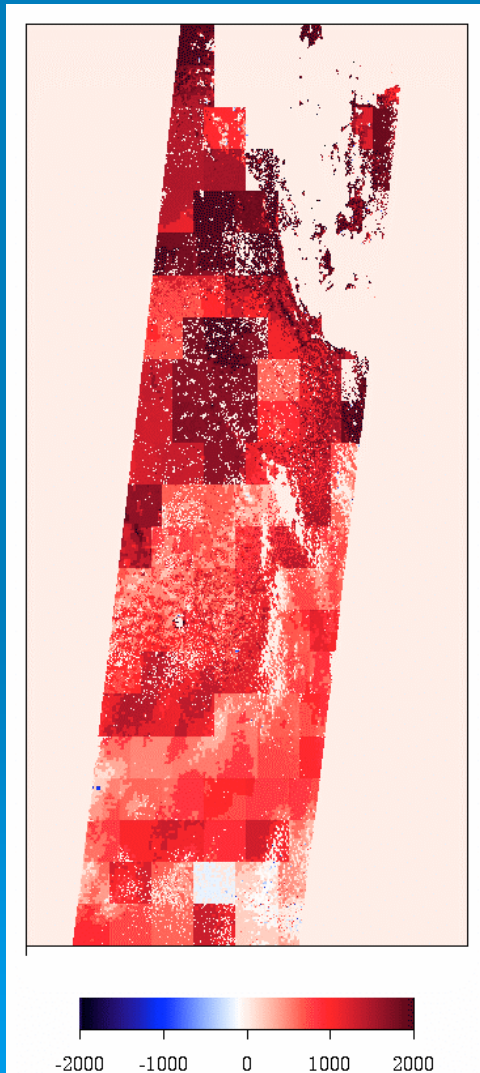


Collection 5 - Collection 4

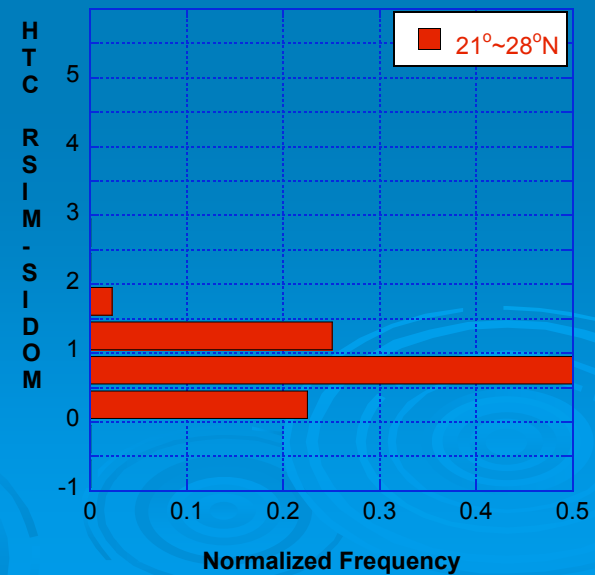


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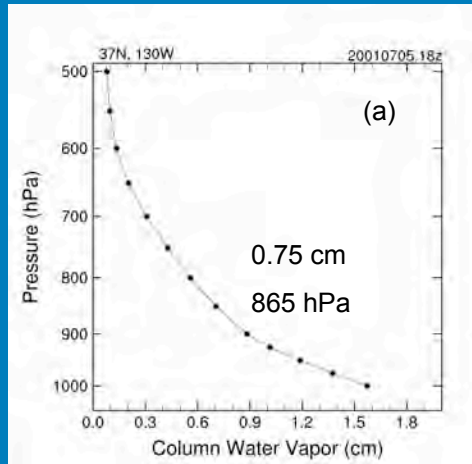
MODIS – MISR CTH [m]



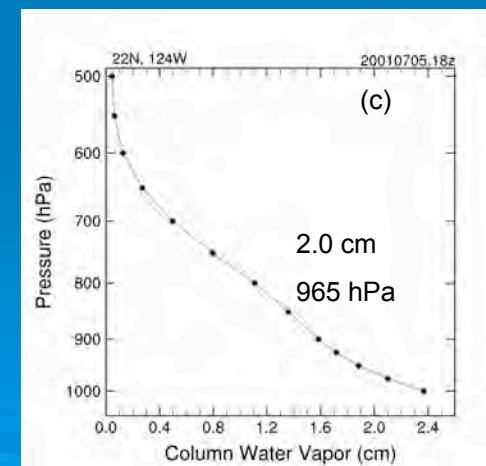
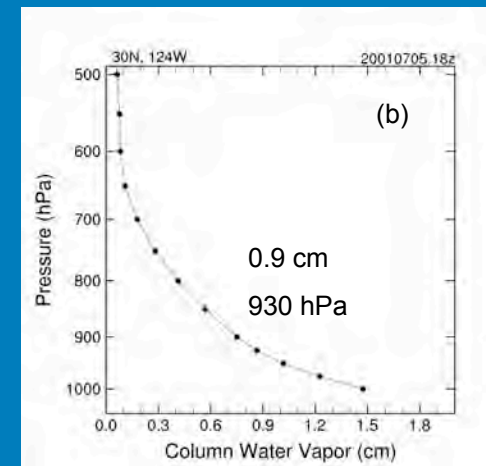
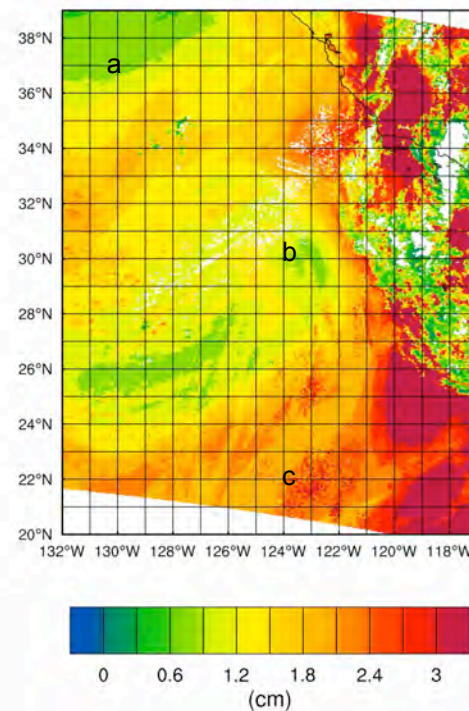
Weak Inversion
Broken Clouds



Near-IR Water Vapor Column Amount

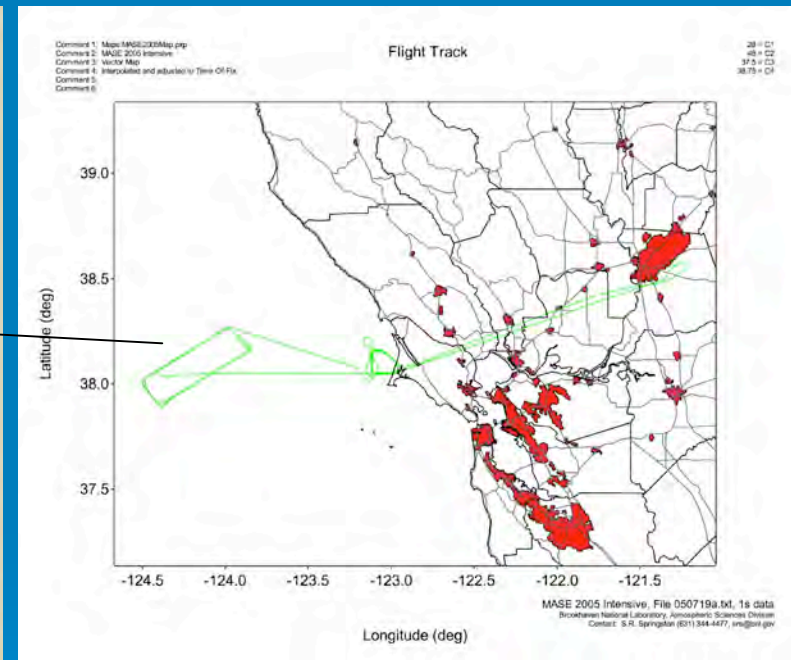
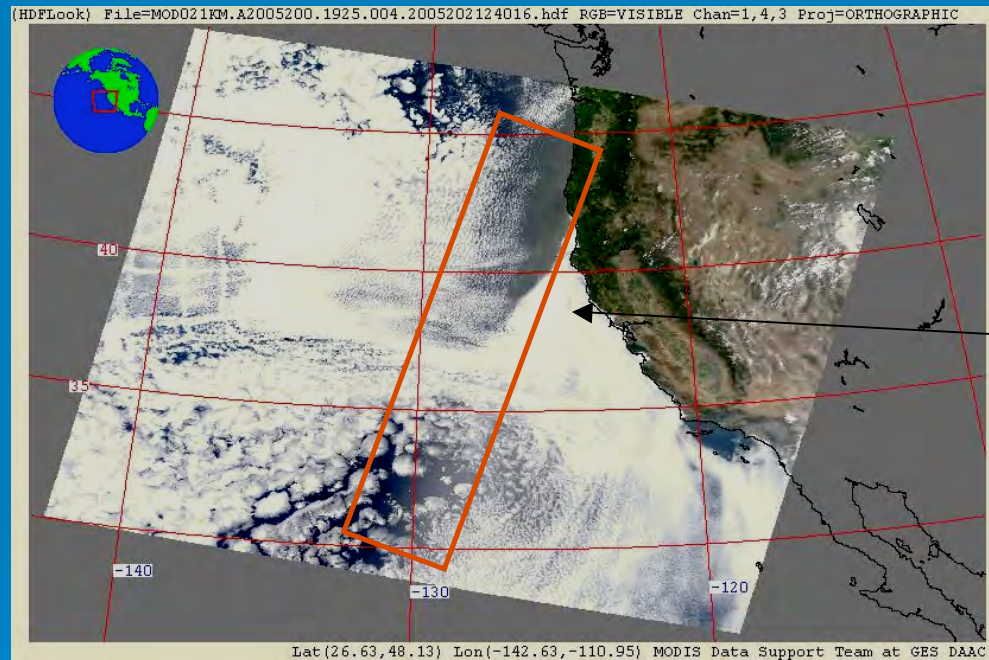


Terra MODIS Water_Vapor_Near_Infrared
MOD05_L2.A2001186.1905.005.2006158134304.hdf



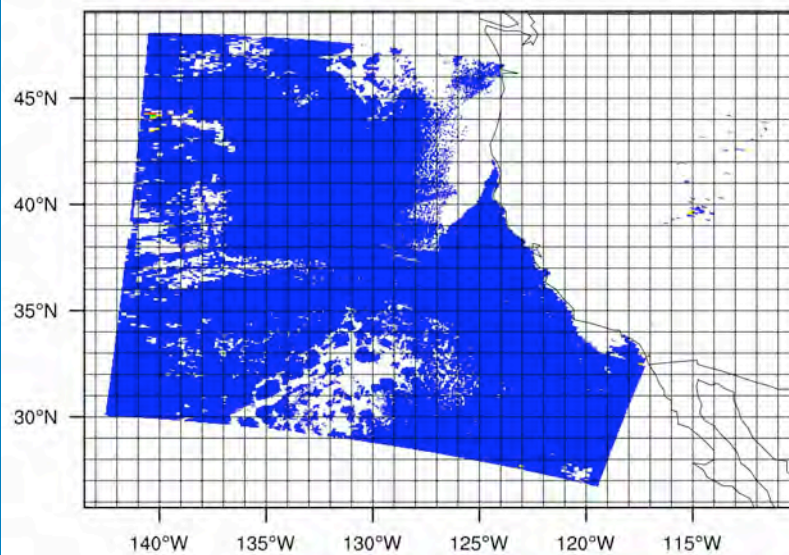
July 19 2005 1925 UTC

Marine Stratus Experiment



Terra MODIS Multilayer Cloud & Phase Flag

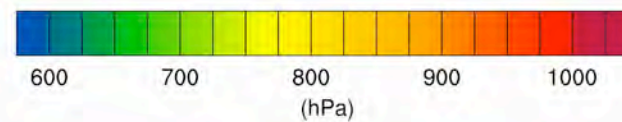
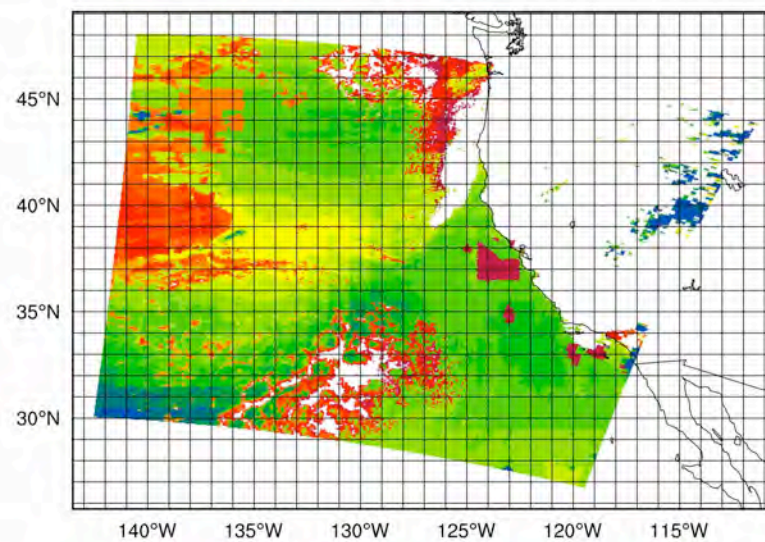
MOD06_L2.A2005200.1925.005.2006224050414.hdf



0-1=No Ret, 2=Single Water, 3=Multi Water, 4=Single Ice, 5=Multi Ice, 6=Single Unk, 7=Multi Unk

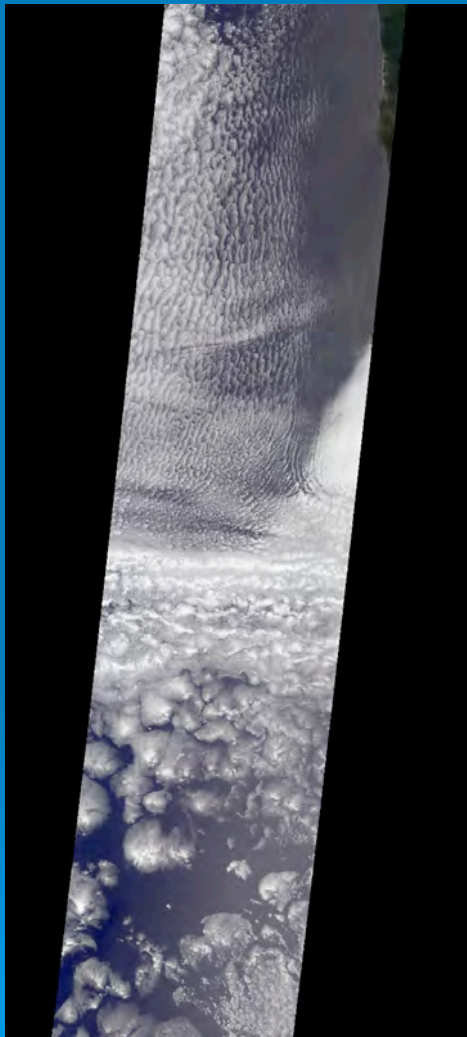
Terra MODIS Cloud_Top_Pressure

MOD06_L2.A2005200.1925.005.2006224050414.hdf

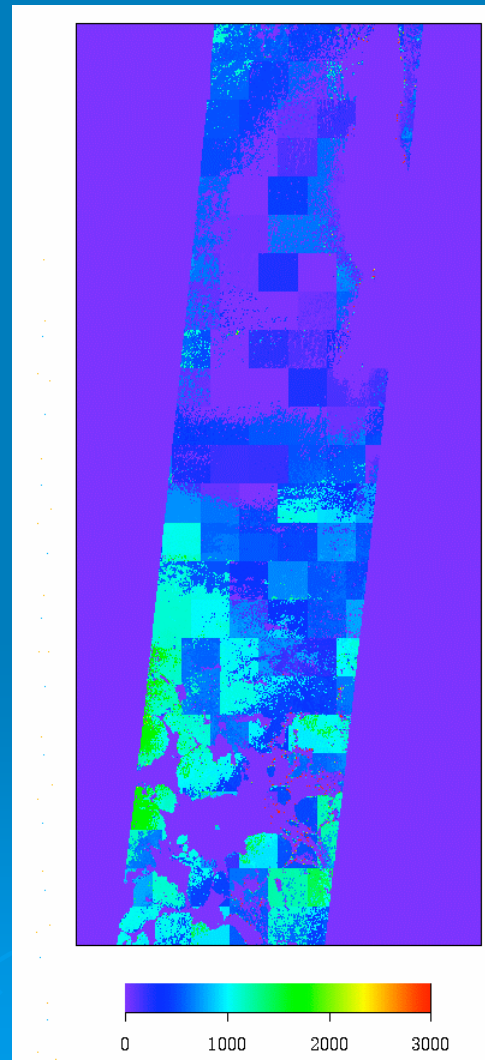


MISR MODIS Comparison

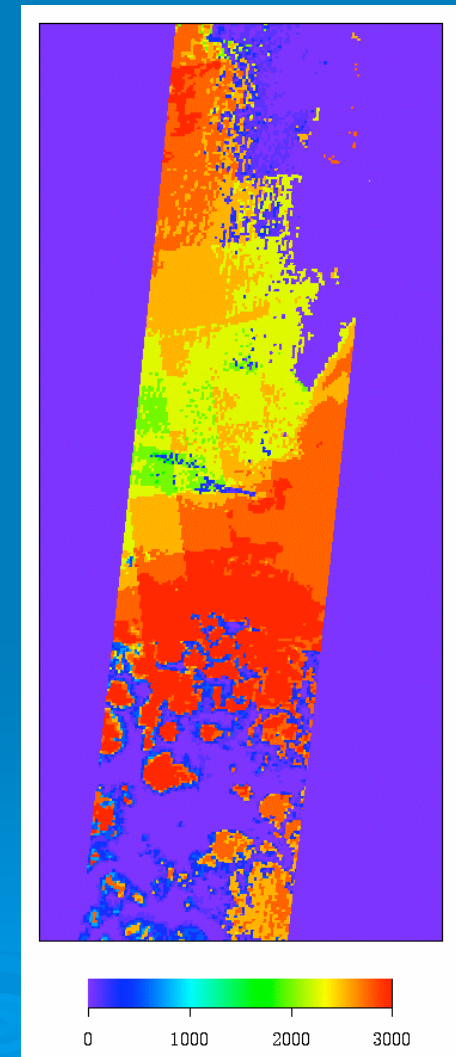
MISR AN RGB



MISR CTH [m]

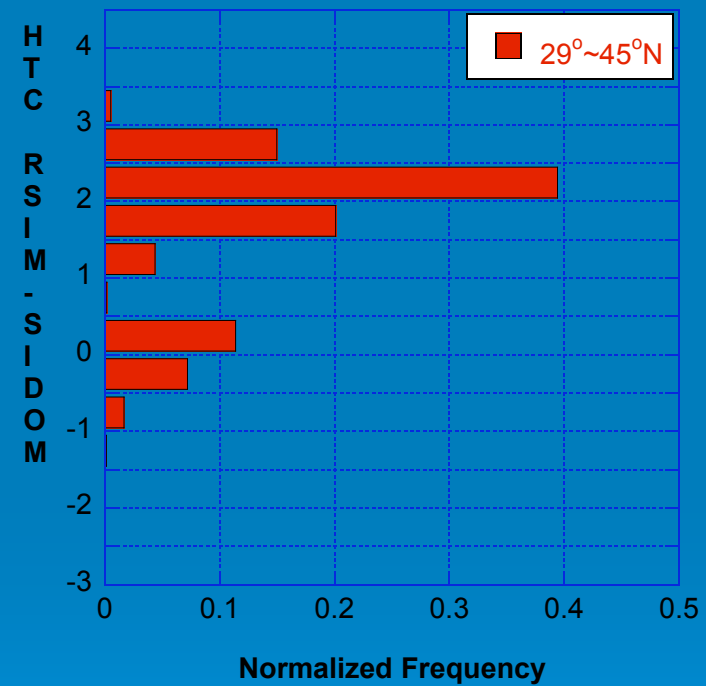
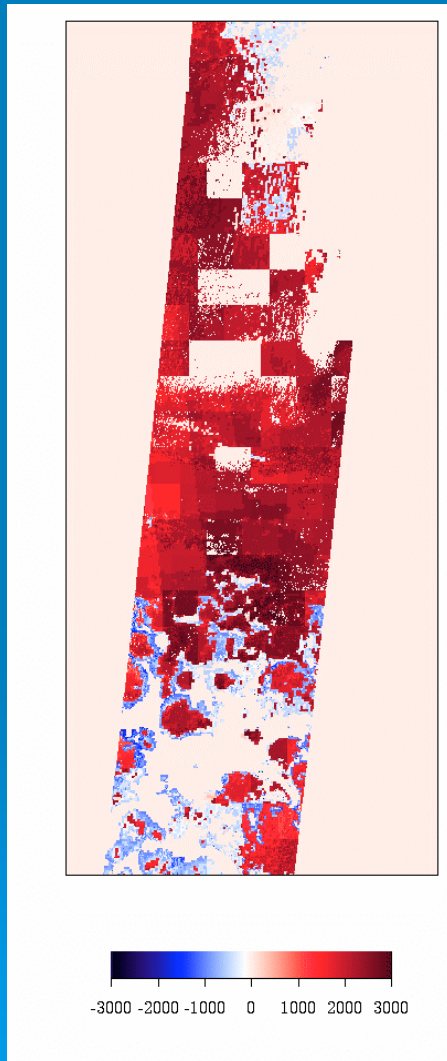


MODIS Collection 5 [m]



MISR MODIS Comparison

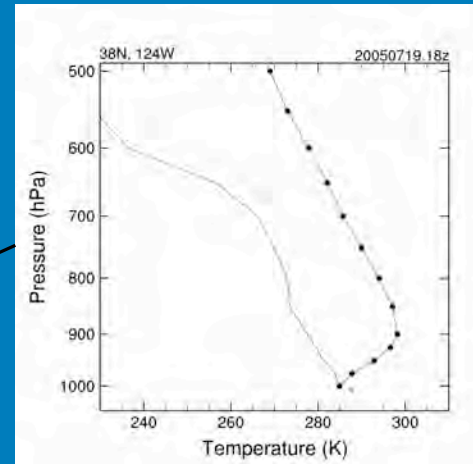
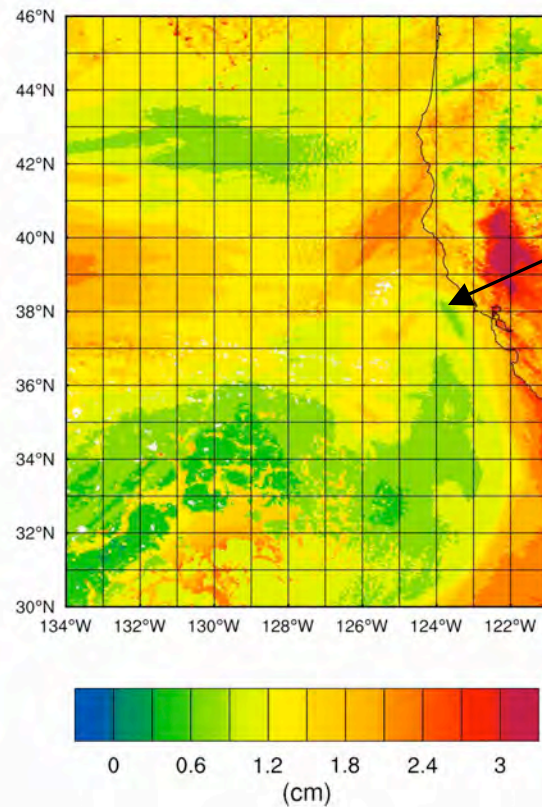
MODIS – MISR CTH [m]



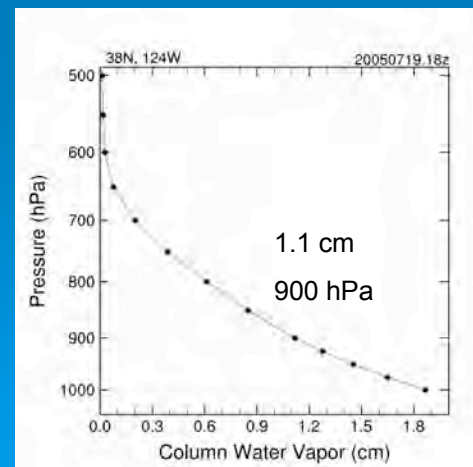
NCEP GDAS analysis for 38N 124W

Terra MODIS Water_Vapor_Near_Infrared

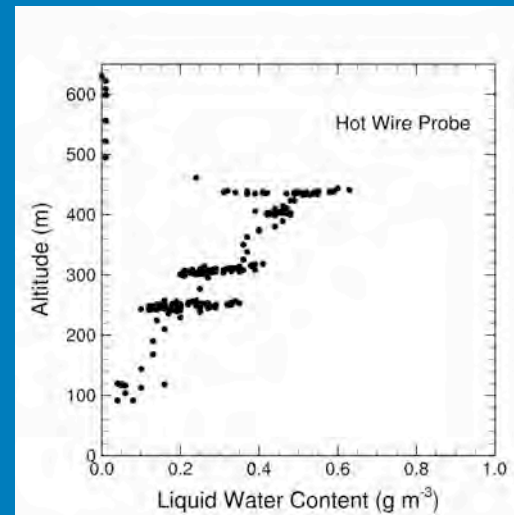
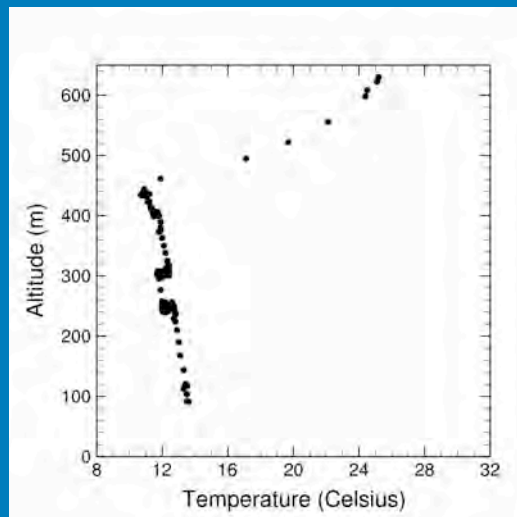
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Near-IR water vapor above cloud and corresponding cloud top pressure

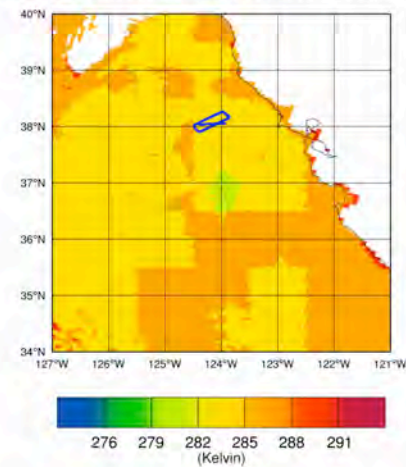


Temperature and Liquid Water Content Profiles Made During the Racetrack Leg of the MASE Flight on July 19 2005 from 1800 to 1930 UTC



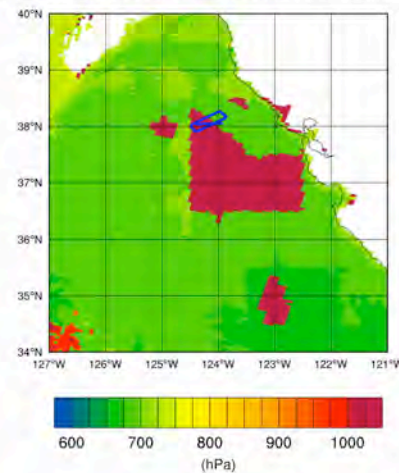
**Terra MODIS Cloud_Top_Temperature
MASE Flight Path**

MOD06_L2.A2005200.1925.005.2006224050414.hdf

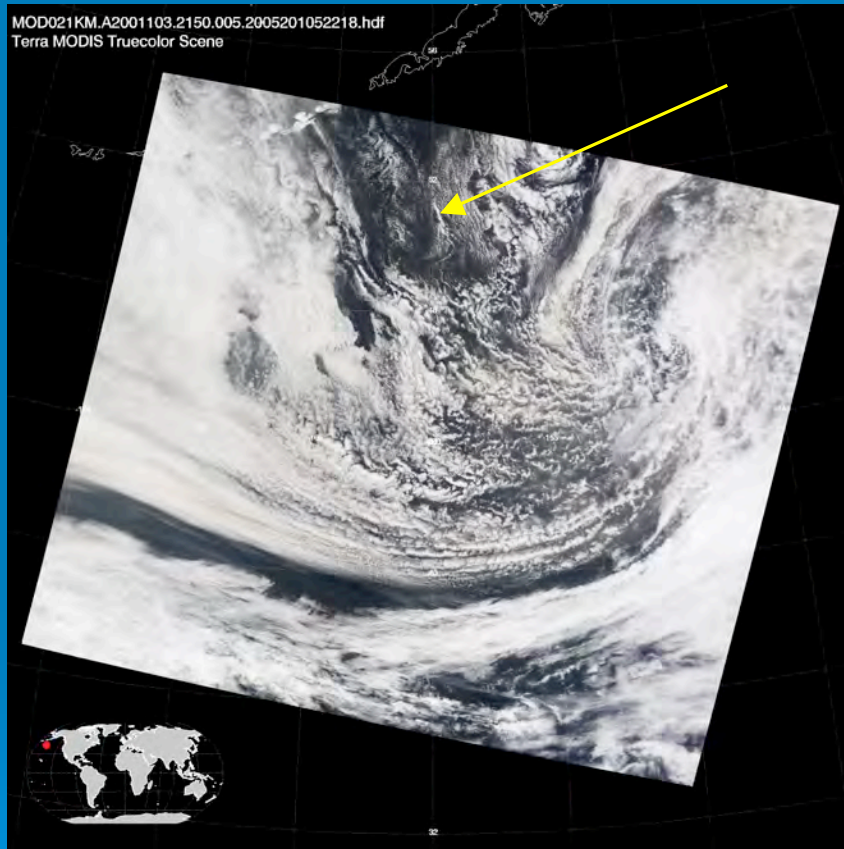


**Terra MODIS Cloud_Top_Pressure
MASE Flight Path**

MOD06_L2.A2005200.1925.005.2006224050414.hdf

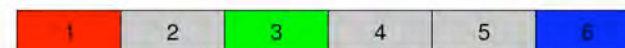
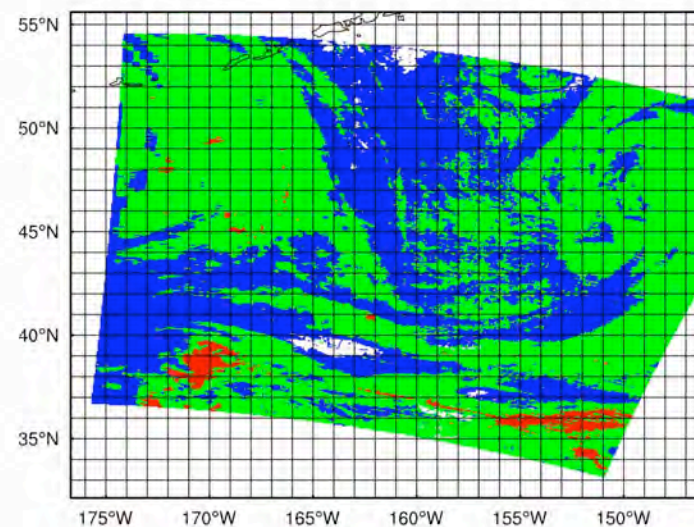


April 13 2001 2150 UTC



Terra MODIS Cloud_Height_Method

MOD06_L2.A2001103.2150.005.2006292213247.hdf



- 1 - CO₂-slicing retrieval from bands 36 and 35
- 3 - CO₂-slicing retrieval from bands 35 and 33
- 6 - window channel retrieval

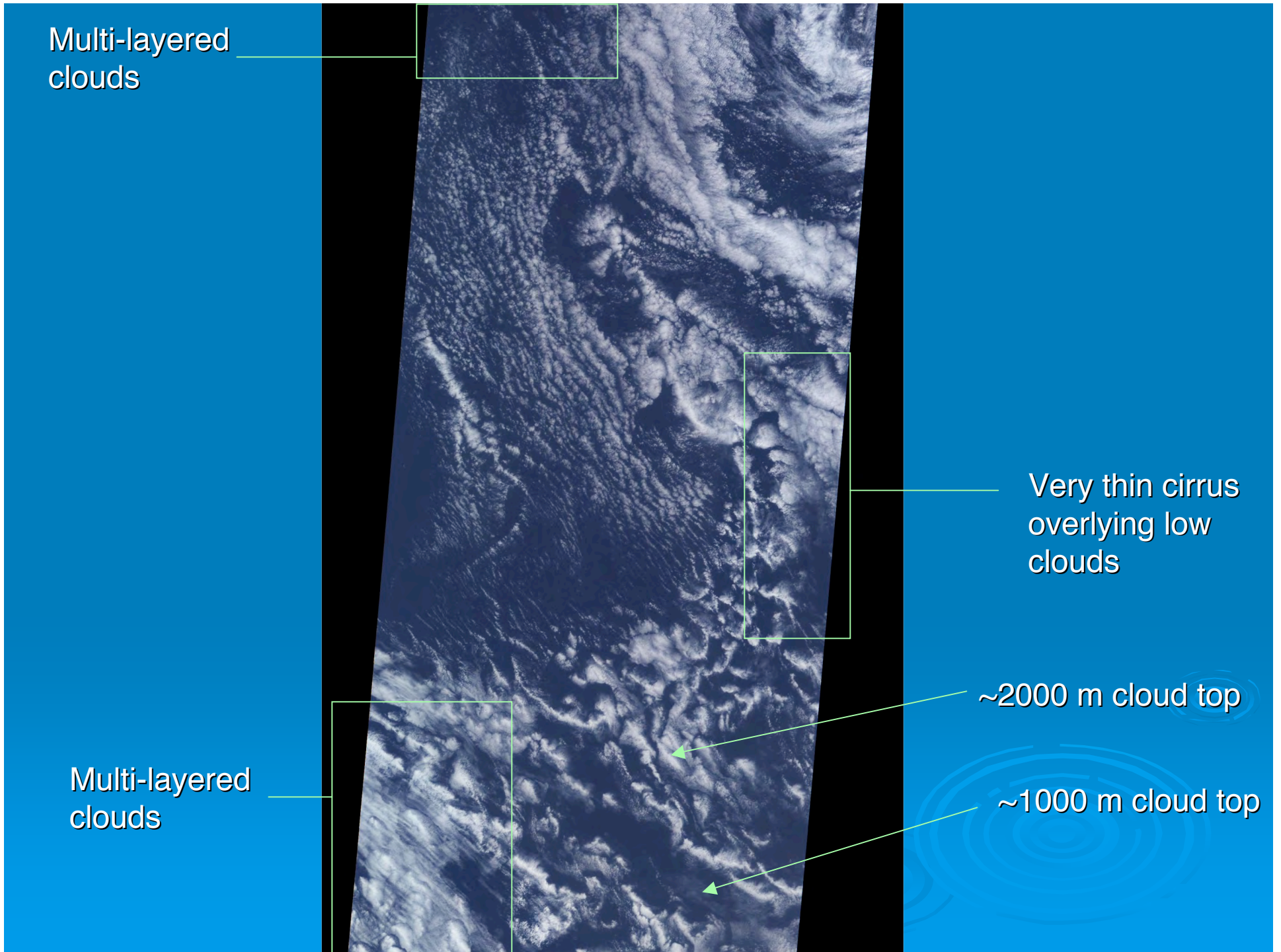
Multi-layered
clouds

Multi-layered
clouds

Very thin cirrus
overlying low
clouds

~2000 m cloud top

~1000 m cloud top

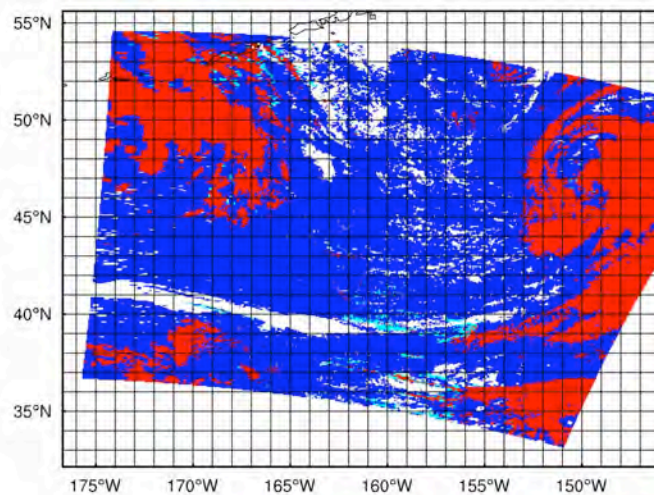


April 13 2001 2150 UTC

Collection 5

Terra MODIS Primary Cloud Retrieval Phase Flag

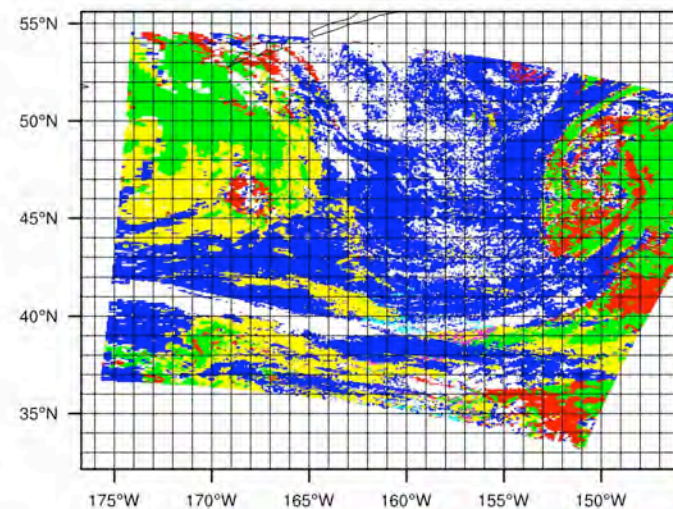
MOD06_L2.A2001103.2150.005.2006292213247.hdf



0=Missing, 1=Clear, 2=Liquid, 3=Ice, 4=Undetermined

Terra MODIS Multilayer Cloud & Phase Flag

MOD06_L2.A2001103.2150.005.2006292213247.hdf



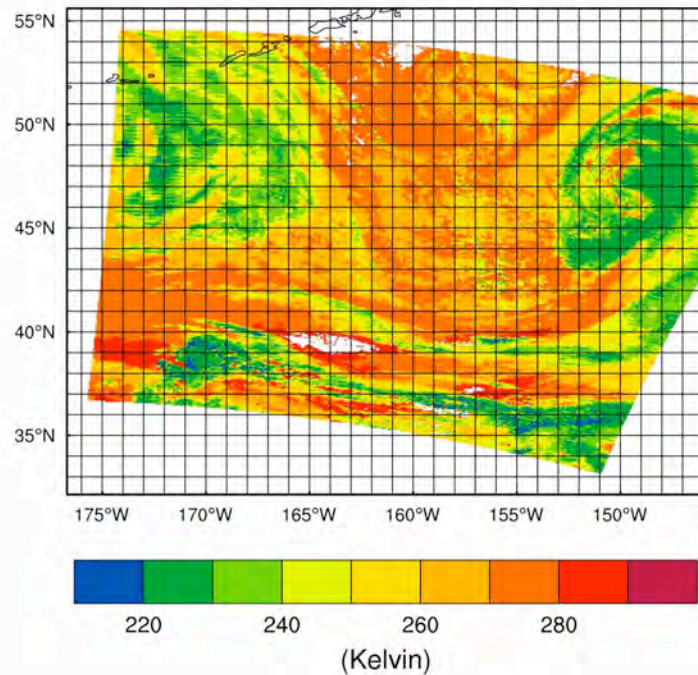
0-1=No Ret, 2=Single Water, 3=Multi Water, 4=Single Ice, 5=Multi Ice, 6=Single Unk, 7=Multi Unk

April 13 2001 2150 UTC

Collection 5

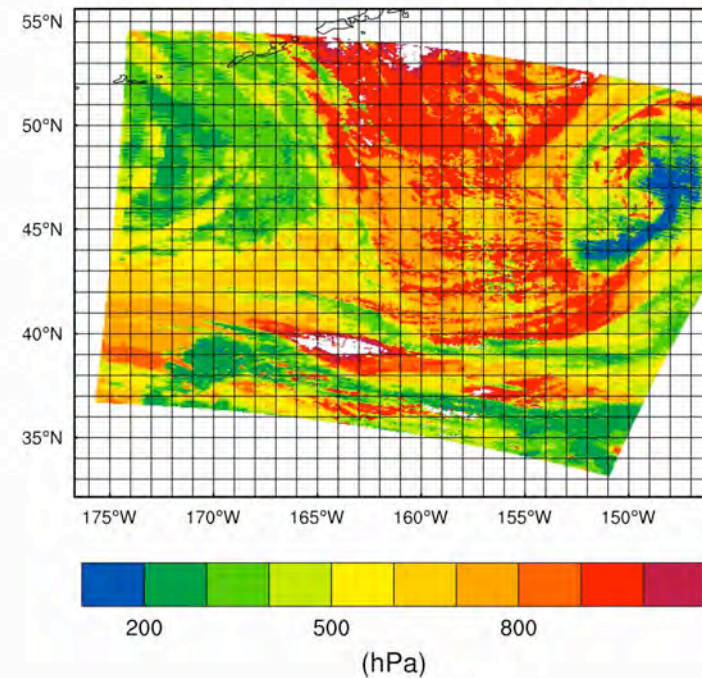
Terra MODIS Cloud_Top_Temperature

MOD06_L2.A2001103.2150.005.2006292213247.hdf



Terra MODIS Cloud_Top_Pressure

MOD06_L2.A2001103.2150.005.2006292213247.hdf

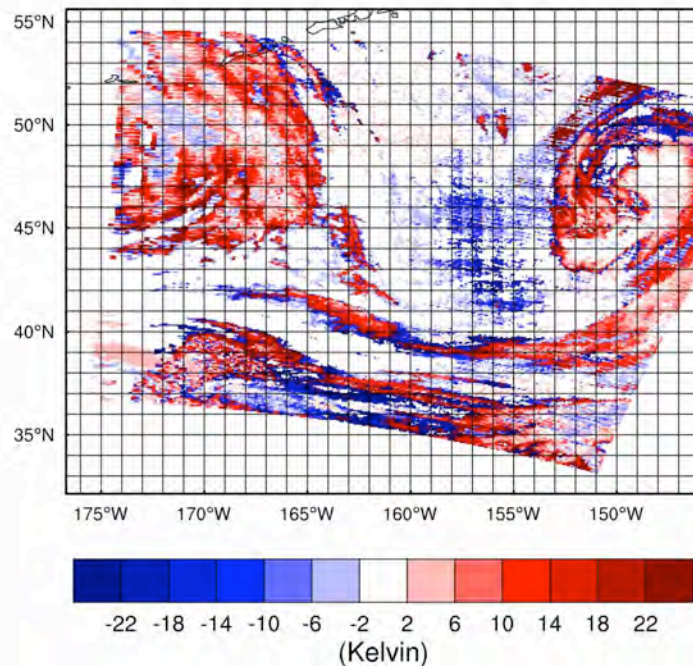


April 13 2001 2150 UTC

Collection 5 – Collection 4

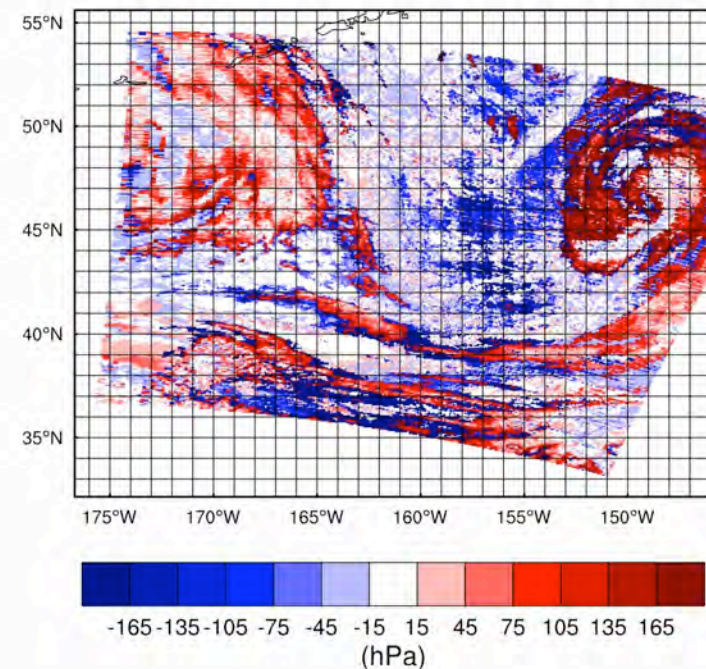
Terra MODIS Cloud_Top_Temperature Collection 5 - 4

MOD06_L2.A2001103.2150.005.2006292213247.hdf
MOD06_L2.A2001103.2150.004.2003083085020.hdf



Terra MODIS Cloud_Top_Pressure Collection 5 - 4

MOD06_L2.A2001103.2150.005.2006292213247.hdf
MOD06_L2.A2001103.2150.004.2003083085020.hdf



Concluding Remarks

- For low clouds, the algorithm assigning the *cloud top pressure* to window brightness temperature tends to choose the higher altitude solution when the temperature profile has a strong inversion
- Ancillary information in the form of near-infrared water vapor column amount above cloud top can be used to choose the appropriate solution if more than one solution has been provided
- For Terra, MISR can provide additional input and for Aqua, CLOUDSAT may play a similar role
- Although this problem can be detected when studying granule level data, there is harm in letting it percolate up to spatially and temporally averaged information provided to climate modelers and the general public